

NODE=B044

 $\Sigma(1670) 3/2^-$ $I(J^P) = 1(\frac{3}{2}^-)$ Status: ***

For most results published before 1974 (they are now obsolete), see
our 1982 edition Physics Letters **111B** 1 (1982).

Results from production experiments are listed separately in the next
entry.

 $\Sigma(1670)$ MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
1665 to 1685 (≈ 1670) OUR ESTIMATE			
1673 \pm 1	GAO	12	DPWA $\bar{K}N \rightarrow \Lambda\pi$
1665.1 \pm 4.1	KOISO	85	DPWA $K^- p \rightarrow \Sigma\pi$
1682 \pm 5	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
1679 \pm 10	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
1670 \pm 5	GOPAL	77	DPWA $\bar{K}N$ multichannel
1670 \pm 6	HEPP	76B	DPWA $K^- N \rightarrow \Sigma\pi$
1685 \pm 20	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
1659 $^{+12}_{-5}$	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
1670 \pm 2	KANE	74	DPWA $K^- p \rightarrow \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1667 or 1668	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel
1650	DEBELLEFON	76	IPWA $K^- p \rightarrow \Lambda\pi^0$
1671 \pm 3	PONTE	75	DPWA $K^- p \rightarrow \Lambda\pi^0$ (sol. 1)
1655 \pm 2	PONTE	75	DPWA $K^- p \rightarrow \Lambda\pi^0$ (sol. 2)

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 $\Sigma(1670)$ WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
40 to 80 (≈ 60) OUR ESTIMATE			
52 $^{+5}_{-2}$	GAO	12	DPWA $\bar{K}N \rightarrow \Lambda\pi$
65.0 \pm 7.3	KOISO	85	DPWA $K^- p \rightarrow \Sigma\pi$
79 \pm 10	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
56 \pm 20	ALSTON-...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
50 \pm 5	GOPAL	77	DPWA $\bar{K}N$ multichannel
56 \pm 3	HEPP	76B	DPWA $K^- N \rightarrow \Sigma\pi$
85 \pm 25	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
32 \pm 11	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
79 \pm 6	KANE	74	DPWA $K^- p \rightarrow \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
46 or 46	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel
80	DEBELLEFON	76	IPWA $K^- p \rightarrow \Lambda\pi^0$
44 \pm 11	PONTE	75	DPWA $K^- p \rightarrow \Lambda\pi^0$ (sol. 1)
76 \pm 5	PONTE	75	DPWA $K^- p \rightarrow \Lambda\pi^0$ (sol. 2)

OCCUR=2

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 $\Sigma(1670)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 N\bar{K}$	7–13 %
$\Gamma_2 \Lambda\pi$	5–15 %
$\Gamma_3 \Sigma\pi$	30–60 %
$\Gamma_4 \Lambda\pi\pi$	
$\Gamma_5 \Sigma\pi\pi$	
$\Gamma_6 \Sigma(1385)\pi$	
$\Gamma_7 \Sigma(1385)\pi$, S-wave	
$\Gamma_8 \Lambda(1405)\pi$	
$\Gamma_9 \Lambda(1520)\pi$	

DESIG=1;OUR EST

DESIG=2;OUR EST

DESIG=3;OUR EST

DESIG=4

DESIG=5

DESIG=55

DESIG=6

DESIG=7

DESIG=8

The above branching fractions are our estimates, not fits or averages.

$\Sigma(1670)$ BRANCHING RATIOS

See "Sign conventions for resonance couplings" in the Note on Λ and Σ Resonances.

$\Gamma(N\bar{K})/\Gamma_{\text{total}}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.07 to 0.13 OUR ESTIMATE			

0.10 ± 0.03	GOPAL	80	DPWA $\bar{K}N \rightarrow \bar{K}N$
0.11 ± 0.03	ALSTON...	78	DPWA $\bar{K}N \rightarrow \bar{K}N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.08 ± 0.03	GOPAL	77	DPWA See GOPAL 80
0.07 or 0.07	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel

Γ_1/Γ

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$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1670) \rightarrow \Lambda\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
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$0.081^{+0.002}_{-0.004}$	GAO	12	DPWA $\bar{K}N \rightarrow \Lambda\pi$
0.17 ± 0.03	² MORRIS	78	DPWA $K^- n \rightarrow \Lambda\pi^-$
0.13 ± 0.02	² MORRIS	78	DPWA $K^- n \rightarrow \Lambda\pi^-$
+0.10 ± 0.02	GOPAL	77	DPWA $\bar{K}N$ multichannel
+0.06 ± 0.02	BAILLON	75	IPWA $\bar{K}N \rightarrow \Lambda\pi$
+0.09 ± 0.02	VANHORN	75	DPWA $K^- p \rightarrow \Lambda\pi^0$
+0.018 ± 0.060	DEVENISH	74B	Fixed-t dispersion rel.
• • • We do not use the following data for averages, fits, limits, etc. • • •			
+0.08 or +0.08	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel
+0.05	DEBELLEFON	76	IPWA $K^- p \rightarrow \Lambda\pi^0$
0.08 ± 0.01	PONTE	75	DPWA $K^- p \rightarrow \Lambda\pi^0$ (sol. 1)
0.17 ± 0.01	PONTE	75	DPWA $K^- p \rightarrow \Lambda\pi^0$ (sol. 2)

$(\Gamma_1\Gamma_2)^{1/2}/\Gamma$

NODE=B044R5
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OCCUR=2

$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1670) \rightarrow \Sigma\pi$

VALUE	DOCUMENT ID	TECN	COMMENT
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+0.20 ± 0.02	KOISO	85	DPWA $K^- p \rightarrow \Sigma\pi$
+0.21 ± 0.02	GOPAL	77	DPWA $\bar{K}N$ multichannel
+0.20 ± 0.01	HEPP	76B	DPWA $K^- N \rightarrow \Sigma\pi$
+0.21 ± 0.03	KANE	74	DPWA $K^- p \rightarrow \Sigma\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
+0.18 or +0.17	¹ MARTIN	77	DPWA $\bar{K}N$ multichannel

$(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

NODE=B044R6
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OCCUR=2

$\Gamma(\Lambda\pi\pi)/\Gamma_{\text{total}}$

Γ_4/Γ

NODE=B044R2

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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.11	ARMENTEROS68E	HBC	$K^- p$ ($\Gamma_1=0.09$)
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$(\Gamma_i\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1670) \rightarrow \Sigma(1385)\pi$, S-wave

$(\Gamma_1\Gamma_7)^{1/2}/\Gamma$

NODE=B044R7

NODE=B044R7

VALUE	DOCUMENT ID	TECN	COMMENT
+0.11 ± 0.03	PREVOST	74	DPWA $K^- N \rightarrow \Sigma(1385)\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •			

0.17 ± 0.02	³ SIMS	68	DBC $K^- N \rightarrow \Lambda\pi\pi$
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$\Gamma(\Sigma\pi\pi)/\Gamma_{\text{total}}$

Γ_5/Γ

NODE=B044R3

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• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.14	⁴ ARMENTEROS68E	HBC	$K^- p, K^- d$ ($\Gamma_1=0.09$)
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$\Gamma(\Lambda(1405)\pi)/\Gamma_{\text{total}}$

Γ_8/Γ

NODE=B044R4

NODE=B044R4

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.06	ARMENTEROS68E	HBC	$K^- p, K^- d$ ($\Gamma_1=0.09$)
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$\Gamma_i\Gamma_f/\Gamma_{\text{total}}^2$ in $N\bar{K} \rightarrow \Sigma(1670) \rightarrow \Lambda(1405)\pi$

$\Gamma_1\Gamma_8/\Gamma^2$

NODE=B044R8

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VALUE	DOCUMENT ID	TECN	COMMENT
0.007 ± 0.002	⁵ BRUCKER	70	DBC $K^- N \rightarrow \Sigma\pi\pi$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.03	BERLEY	69	HBC $K^- p$ 0.6–0.82 GeV/c
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$\Gamma(\Lambda(1405)\pi)/\Gamma(\Sigma(1385)\pi)$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	Γ_8/Γ_6
0.23±0.08	BRUCKER	70	DBC	$K^- N \rightarrow \Sigma \pi \pi$

$(\Gamma_1 \Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\bar{K} \rightarrow \Sigma(1670) \rightarrow \Lambda(1520)\pi$	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	$(\Gamma_1 \Gamma_9)^{1/2}/\Gamma$
0.081±0.016	6 CAMERON	77	DPWA	$P\text{-wave decay}$

 $\Sigma(1670)$ FOOTNOTES

- 1 The two MARTIN 77 values are from a T-matrix pole and from a Breit-Wigner fit.
- 2 Results are with and without an S_{11} $\Sigma(1620)$ in the fit.
- 3 SIMS 68 uses only cross-section data. Result used as upper limit only.
- 4 Ratio only for $\Sigma 2\pi$ system in $I = 1$, which cannot be $\Sigma(1385)$.
- 5 Assuming the $\Lambda(1405)\pi$ cross-section bump is due only to $3/2^-$ resonance.
- 6 The CAMERON 77 upper limit on F -wave decay is 0.03.

 $\Sigma(1670)$ REFERENCES

GAO	12	PR C86 025201	P. Gao, J. Shi, B.S. Zou	(BHEP, BEIJT)	REFID=54341
Also		NP A867 41	P. Gao, B.S. Zou, A. Sibirtsev	(BHEP, BEIJT+)	REFID=53734
KOISO	85	NP A433 619	H. Koiso <i>et al.</i>	(TOKY, MASA)	REFID=31795
PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELS, CIT, CERN)	REFID=41167
GOPAL	80	Toronto Conf. 159	G.P. Gopal	(RHEL) IJP	REFID=31755
ALSTON-...	78	PR D18 182	M. Alston-Garnjost <i>et al.</i>	(LBL, MTHO+) IJP	REFID=31751
Also		PRL 38 1007	M. Alston-Garnjost <i>et al.</i>	(LBL, MTHO+) IJP	REFID=31752
MORRIS	78	PR D17 55	W.A. Morris <i>et al.</i>	(FSU) IJP	REFID=32092
CAMERON	77	NP B131 399	W. Cameron <i>et al.</i>	(RHEL, LOIC) IJP	REFID=31749
GOPAL	77	NP B119 362	G.P. Gopal <i>et al.</i>	(LOIC, RHEL) IJP	REFID=31750
MARTIN	77	NP B127 349	B.R. Martin, M.K. Pidcock, R.G. Moorhouse	(LOUC+) IJP	REFID=31762
Also		NP B126 266	B.R. Martin, M.K. Pidcock	(LOUC)	REFID=31763
Also		NP B126 285	B.R. Martin, M.K. Pidcock	(LOUC) IJP	REFID=31764
DEBELLEFON	76	NP B109 129	A. de Bellefon, A. Berthon	(CDEF) IJP	REFID=32158
HEPP	76B	PL 65B 487	V. Hepp <i>et al.</i>	(CERN, HEIDH, MPIM) IJP	REFID=31761
BAILLON	75	NP B94 39	P.H. Baillon, P.J. Litchfield	(CERN, RHEL) IJP	REFID=32089
PONTE	75	PR D12 2597	R.A. Ponte <i>et al.</i>	(MASA, TENN, UCR) IJP	REFID=32114
VANHORN	75	NP B87 145	A.J. van Horn	(LBL) IJP	REFID=32093
Also		NP B87 157	A.J. van Horn	(LBL) IJP	REFID=32094
DEVENISH	74B	NP B81 330	R.C.E. Devenish, C.D. Froggatt, B.R. Martin	(DESY+) IJP	REFID=30036
KANE	74	LBL-2452	D.F. Kane	(LBL) IJP	REFID=31759
PREVOST	74	NP B69 246	J. Prevost <i>et al.</i>	(SACL, CERN, HEID) IJP	REFID=31785
BRUCKER	70	Duke Conf. 155	E.B. Brucker <i>et al.</i>	(FSU) I	REFID=32142
Hyperon Resonances, 1970					
BERLEY	69	PL 30B 430	D. Berley <i>et al.</i>	(BNL)	REFID=31775
ARMENTEROS	68E	PL 28B 521	R. Armenteros <i>et al.</i>	(CERN, HEID, SACL) I	REFID=32136
SIMS	68	PRL 21 1413	W.H. Sims <i>et al.</i>	(FSU, TUFTS, BRAN) I	REFID=32137